

Rec'd PCT/PTC 11 MAR 2005

WO 2004/035295 A1



SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *with international search report*

ARTICLES COMPRISING A FIBER-REINFORCED THERMOPLASTIC POLYMER COMPOSITION

This invention relates to a method to make a fiber-reinforced thermoplastic polymer composition comprising an elastomer and fabricated articles therefrom.

Molded articles comprising thermoplastic polymers, in particularly propylene polymers, find wide use in a large variety of applications, for example fabricated articles in automobiles, home appliances, electronic housings, furniture, floor coverings and wall coverings.

Physical property requirements for such articles are varied and application dependent. It is well-known to this art that thermoplastic polymers can contain non-polymeric materials as fillers, in order to alter certain of their properties. Thus, various mineral or inorganic fillers can be used in order to change one or more mechanical property of a thermoplastic polymer, such as coefficient of linear thermal expansion; modulus; impact strength, especially low temperature impact strength; tensile strength; flexural strength and resilience.

The process of forming a sheet of reinforced thermoplastic material, such as glass fiber-reinforced polypropylene, is well known. For example, the U.S. Pat. No. 4,439,387 shows a method of manufacturing a composite reinforcing structure by extruding fluid thermoplastic resin through an elongated die simultaneously with introducing a plurality of continuous fiber reinforcing strands into the die. However, the resulting composite demonstrates anisotropic mechanical properties. Improved performance is achieved by adding randomly oriented fibers and/or additional fillers.

Typically, molders of fabricated articles formed of reinforced thermoplastic material purchase the material from a manufacturer in a desired preform such as a sheet or a mat. The mat can be formed of glass fibers and layered in a thermoplastic resin such as polypropylene. The molder reheats the preform before inserting it into a molding machine to compression mold the desired part. However, such a procedure has many disadvantages including the inability to quickly change material composition and preform shape when required.

A method to compound a reinforced thermoplastic material in a continuous process, but limited to compression molded articles is taught in U.S. Patent No. 5,401,154. However, the process is not cost effective as it runs at low output rates and requires

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/30267

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B29C47/00 B29C47/10 B29C45/54 B29C31/04 B29C47/50

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

PAJ, WPI Data, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 424 020 A (MATUBARA SHIGEYOSHI ET AL) 13 June 1995 (1995-06-13) column 1, line 16 - line 19 column 3, line 44 - line 54 column 4, line 47 - line 51 column 5, line 1 - line 15 claims; figures ---	1, 4, 6-13, 15-17
P, X	EP 1 323 778 A (GOODYEAR TIRE & RUBBER) 2 July 2003 (2003-07-02) page 3, line 54 - line 58 page 7, line 11 - line 13 page 8, line 5 - line 15 page 9, line 55 - page 10, line 6 figure 1 --- -/--	1, 4-13, 16, 17

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

30 January 2004

Date of mailing of the international search report

05/02/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Jensen, K

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/30267

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>WO 02 43943 A (GEN ELECTRIC) 6 June 2002 (2002-06-06) page 7, line 11 - line 15 page 10, line 15 -page 11, line 19 page 16, line 26 -page 17, line 2 page 17, line 7 -page 18, line 8 figures 1-3 claims 1,5,8-14</p> <p style="text-align: center;">---</p>	1-17
A	<p>US 3 352 952 A (MARR JOHN A) 14 November 1967 (1967-11-14) column 3, line 8 - line 24 claims 1-3; figure 1</p> <p style="text-align: center;">---</p>	1-17
A	<p>FR 2 777 221 A (ECIA EQUIP COMPOSANTS IND AUTO) 15 October 1999 (1999-10-15) page 3, line 33 -page 4, line 10 claims; figures</p> <p style="text-align: center;">---</p>	1,4, 14-16
A	<p>US 5 401 154 A (SARGENT MICHAEL M) 28 March 1995 (1995-03-28) cited in the application the whole document</p> <p style="text-align: center;">---</p>	1-17
A	<p>US 5 939 001 A (KREITLOW REINHARD ET AL) 17 August 1999 (1999-08-17) column 2; example</p> <p style="text-align: center;">-----</p>	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 03/30267

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5424020	A	13-06-1995	JP 2850392 B2	27-01-1999
			JP 3076614 A	02-04-1991
			JP 2917372 B2	12-07-1999
			JP 3261519 A	21-11-1991
			CA 2039160 A1	22-02-1991
			DE 69021361 D1	07-09-1995
			DE 69021361 T2	29-02-1996
			EP 0439625 A1	07-08-1991
			ES 2077684 T3	01-12-1995
			WO 9102639 A1	07-03-1991
			KR 181510 B1	15-05-1999
			US 5275776 A	04-01-1994
			CA 2027741 A1	17-04-1991
			EP 0423676 A2	24-04-1991
EP 1323778	A	02-07-2003	EP 1323778 A1	02-07-2003
WO 0243943	A	06-06-2002	AU 1662002 A	11-06-2002
			EP 1339538 A1	03-09-2003
			WO 0243943 A1	06-06-2002
US 3352952	A	14-11-1967	US 3413249 A	26-11-1968
			BE 665698 A	21-12-1965
			FR 1457342 A	24-01-1966
			GB 1063238 A	30-03-1967
			NL 6507914 A	23-12-1965
FR 2777221	A	15-10-1999	FR 2777221 A1	15-10-1999
			DE 29906250 U1	05-08-1999
US 5401154	A	28-03-1995	NONE	
US 5939001	A	17-08-1999	DE 19548854 A1	03-07-1997
			BR 9606199 A	25-08-1998
			CZ 9603705 A3	16-07-1997
			DE 59610238 D1	24-04-2003
			EP 0782909 A2	09-07-1997
			ES 2192596 T3	16-10-2003
			HU 9603560 A1	28-08-1998
			ZA 9610455 A	09-07-1997